Connecting the Sun and the Solar Wind: Latitudinal Profiles of Density and Velocity

Shadia Rifai Habbal[1] (617-495-7348; shabbal@cfa.harvard.edu)
Richard Woo[2] (818-354-3946; rwoo@mail1.jpl.nasa.gov)

[1]Harvard-Smithsonian Center for Astrophysics, 60 Garden St., MS 15, Cambridge, MA 02138
[2]JPL/Caltech, 4800 Oak Grove Dr., Pasadena, CA 91109

A comparison of the latitudinal variation of Ulysses density measurements and polarized brightness (pB) observations of the inner corona covering the time period of the Ulysses slow scans of the south (-30° to -80°) and north (80° to 30°) polar regions of the Sun in 1992-1994 and 1995 respectively, when the wind speed exceeded 650 km/s, is presented. A 27 day running average was used for the Ulysses data while the corresponding pB measurements were averaged over the two time intervals. A remarkable similarity between the coronal and in situ density latitudinal profiles emerges from this comparison, with a clearly defined transition between the radial extension of the polar coronal holes and the surrounding quiet Sun. The distinction between coronal holes and quiet Sun is also evident in the latitudinal profiles of velocity. Anticorrelated with density, the solar wind speed is highest within the angular extent of the polar coronal holes and decreases gradually beyond their boundaries. The comparison between density and velocity profiles thus provides an explanation for the origin of the puzzling systematic decrease of fast wind speed with decreasing latitude reported in earlier investigations of the Ulysses data. Given that the angular extent of both coronal holes and quiet Sun is preserved from the Sun out into interplanetary space, these results provide unambiguous evidence that the fast solar wind detected at mid latitudes by Ulysses around solar minimum originates from the quiet Sun, while the fast wind at latitudes above 60° has its origin in the polar coronal holes. Furthermore, comparison of the latitudinal profile of the radial magnetic field with the density profile also shows a surprising similarity, with a minimum within the radial extensions of the coronal hole boundaries, implying that the magnetic field linked to the fast solar wind is weakest in the polar regions at the Sun.

American Geophysical Union Abstract Form

Reference # 8514

1. Spring Meeting 2000
2. AGU-00108108
3. (a) Shadia Rifai Habbal
   Harvard-Smithsonian Center for Astrophysics, 60 Garden St., MS 15
   Cambridge, MA 02138
   (b) 617-495-7348
   (c) 617-495-7049
   (d) shabbal@cfa.harvard.edu
4. SH
5. (a)
   (b) 2164, 2169, 7509, 7611
   (c)
6. N/A
7. 0% published elsewhere
8. $00
   Shadia R. Habbal
   Visa
   xxxx xxxx xxxx 2489
9. C
10. Please schedule before the paper by Woo and Habbal, Connecting the Sun and the Solar Wind: Longitudinal Variations of Density and Velocity
11. Regular author

Date received: March 9, 2000
Date formatted: March 9, 2000
Form version: 1.0